THE CONSTRUCTION OF A BETA-RAY SPECTROMETER AND THE BETA-RAY SPECTRUM OF ANTIMONY 124

BY

EVERETT BURTON HALES

A.B., Miami University, 1936

M.S., University of Illinois, 1938

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN PHYSICS IN THE GRADUATE SCHOOL OF THE UNIVERSITY OF ILLINOIS, 1942

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THE CONSTRUCTION OF A BETA-RAY SPECTROMETER AND THE BETA-RAY SPECTRUM OF Sb^{124}

A medium resolving power, high intensity beta-ray spectrometer of economical design has been constructed and used to study the continuous beta-ray spectrum of Sb^{124}. An essential part of the apparatus is an adjustable slit system, mounted on a central support within a vacuum chamber. The slits are arranged so that their centers lie on an arc of a circle which has a radius of 7.5 cm. When placed in a uniform magnetic field, it is possible with this arrangement, to select and study beta rays of a given momentum and thus to investigate the continuous beta ray spectra of radioactive substances.

A Geiger-Müller counter of conventional design is used to record the beta-rays, and a flip coil, mounted within the chamber and connected to a ballistic galvanometer, is used to determine the magnetic field strength.

A detailed study of the beta-rays from Sb^{124} shows that this spectrum is complex. The end points assigned to the two components are 2.43 ± 0.06 Mev and 0.71 ± 0.03 Mev. The difference between these energies, i.e., 1.72 ± 0.07 Mev agrees, within the probable errors, with the known energy of the strong gamma-ray from Sb^{124}. In addition, a very weak gamma-ray internal conversion line of 0.204 ± 0.007 Mev was observed.

The origin of this line is not definitely known.

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VITA

Everett Burton Hales was born at Columbia Station, Ohio, on October 22, 1914. He received his elementary and high school education in the public schools at Columbia Center, Ohio, and at North Eaton, Ohio. He attended Miami University from 1932 until his graduation in 1936. He received an A.B. degree, cum laude, with honors in physics. He was a teaching assistant and graduate student in the Department of Physics at the University of Illinois from 1936 to 1942. He received the M.S. degree from the University of Illinois in 1938. He is affiliated with the Society of Sigma Xi.